Test #8

1. a buffer is special in the way it behaves because it is resistant to changes in pH ✓

2. C. is one of the mixtures that would make a buffer ✓

3. a. $HCl + HCO_3^- \rightarrow H_2CO_3 + Cl^-$ ✓

b. $NaOH + H_2CO_3 \rightarrow HCO_3^- + Na^+ + H_2O$ ✓

4. $Al(OH)_3$ will be more soluble in a pH = 3 solution ✓

5. $$\left(\frac{50.0g\ of\ KHCO_3}{1}\right)\left(\frac{1\ mole\ of\ KHCO_3}{100.1g\ of\ KHCO_3}\right) = 0.500\ moles\ of\ KHCO_3$$ ✓

$$\left(\frac{0.500\ moles\ of\ KHCO_3}{0.1000\ L}\right) = 5.00M\ KHCO_3$$ ✓

$$\left(\frac{30.0g\ of\ K_2CO_3}{1}\right)\left(\frac{1\ mole\ of\ K_2CO_3}{138.2g\ of\ K_2CO_3}\right) = 0.217\ moles\ of\ K_2CO_3$$ ✓

$$\left(\frac{0.217\ moles\ of\ K_2CO_3}{0.1000L}\right) = 2.17M\ K_2CO_3$$ ✓

$$pKa = -\log(HCO_3^-) = -\log(7.0\times10^{-11}) = 10.15$$

$$pH = 10.15 + \log\left(\frac{2.17}{5.00}\right)$$
$$= 10.15 + (-0.363) = 9.79$$ ✓

$$\frac{22}{22}$$

100%

6. $\left(\frac{10.0\text{ g of KOH}}{1}\right)\left(\frac{1\text{ mole of KOH}}{56.1\text{ g of KOH}}\right) = 0.178$ moles of KOH

$\left(\frac{3.50\text{ moles of } H_2S}{1\text{ L}}\right)\left(\frac{0.1000\text{ L}}{1}\right) = 0.350$ moles of H_2S

$pH = 7.00 + \log\left(\frac{0.178}{0.350 - 0.178}\right) = 7.00 + \log\left(\frac{0.178}{0.172}\right) = 7.00 + 0.015$
$= 7.02$

7. $pKa = -\log(1.8 \times 10^{-5}) = 4.74$

$pH = 4.74 + \log\left(\frac{1.2}{1.5}\right) = 4.7 + (-0.097) = 4.64$

8. $\left(\frac{10.0\text{ g of KOH}}{1}\right)\left(\frac{1\text{ mole of KOH}}{56.1\text{ g of KOH}}\right) = 0.178$ moles of KOH

$pH = 4.74 + \log\left(\frac{1.4}{1.3}\right) = 4.74 + 0.03 = 4.77$

9. $pH = -\log(H_3O^+)$

$-1(9.70) = (-\log(H_3O^+))-1$

$-9.70 = \log(H_3O^+)$

$[H_3O^+] = 10^{-9.70}$

$[H_3O^+] = 2.0 \times 10^{-10}$

initial pH = 9.70

$\frac{(2.0 \times 10^{-10})(OH)}{2.0 \times 10^{-10}} = \frac{1 \times 10^{-14}}{2.0 \times 10^{-10}}$

$[OH] = 5.0 \times 10^{-5}$

$7.9\times10^{-15} = X(5.0\times10^{-5})^2$

$\frac{7.9\times10^{-15}}{2.5\times10^{-9}} = \frac{X(2.5\cancel{\times10^{-9}})}{\cancel{2.5}\times10^{-9}}$

$X = 3.2\times10^{-6}$

$7.9\times10^{-15} = x(5.0\times10^{-5} + 2x)^2$

$7.9\times10^{-15} = x(5.0\times10^{-5} + 2(3.2\times10^{-6}))^2$

$7.9\times10^{-15} = x(5.0\times10^{-5} + 6.4\times10^{-6})^2$

$7.9\times10^{-15} = x(5.64\times10^{-5})^2$

$\frac{7.9\times10^{-15}}{3.2\times10^{-9}} = \frac{x(3.2\cancel{\times10^{-9}})}{\cancel{3}.2\times10^{-9}}$ $\quad X = 2.5\times10^{-6}$

$7.9\times10^{-15} = x(5.0\times10^{-5} + 2(2.5\times10^{-6}))^2$

$7.9\times10^{-15} = x(5.0\times10^{-5} + 5.0\times10^{-6})^2$

$\frac{7.9\times10^{-15}}{3.0\times10^{-9}} = \frac{x(3.0\cancel{\times10^{-9}})}{\cancel{3.0}\times10^{-9}}$ $\quad X = 2.6\times10^{-6}$

$7.9\times10^{-15} = x(5.0\times10^{-5} + 2(2.6\times10^{-6}))^2$

$7.9\times10^{-15} = x(5.0\times10^{-5} + 5.2\times10^{-6})^2$

$7.9\times10^{-15} = X(3.0\times10^{-9})$ $\quad x = 2.6\times10^{-6}$

The iron ion concentration is 2.6×10^{-6} M

10. $K_p = \dfrac{P_{CO}(P_{H_2O})}{P_{H_2}(P_{CO_2})}$

$1.67 = \dfrac{(x)(x)}{(5.0-x)(5.0-x)} \Rightarrow 1.67 = \dfrac{x^2}{25-5x-5x+x^2}$

$x^2-10x+25 \cdot 1.67 = \dfrac{x^2}{x^2-10x+25} \cdot x^2-10x+25$

$1.67(x^2-10x+25) = x^2$

$1.67x^2-17x+42 = x^2$

$-x^2 \qquad -x^2$

$0.67x^2-17x+42=0$

$x = \dfrac{17 \pm \sqrt{17^2-4(0.67)(42)}}{2(0.67)}$

$x = \dfrac{17 \pm \sqrt{289-112.56}}{1.34}$

$x = \dfrac{17 \pm \sqrt{176.44}}{1.34}$

$x = \dfrac{17 \pm 13.28}{1.39}$

$x = \cancel{22}$ or 3 The pressure of CO will be 3 atm

11. $6.8 \times 10^6 = \dfrac{(5.0)(15)^3}{(2x)^2}$

$4x^2 \cdot 6.8 \times 10^6 = \dfrac{16875}{4x^2} \cdot 4x^2$

$4x^2(6.8 \times 10^6) = 16875$

$\dfrac{2.72 \times 10^7 x^2}{2.72 \times 10^7} = \dfrac{16875}{27200000}$

$\sqrt{x^2} = \sqrt{6.2040}$

$x = 0.025$ The pressure of ammonia will be 0.050 atms